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ASSESSMENT OF THE ANATOMICAL AND FUNCTIONAL CONDITION OF THE ORAL CAVITY IN INDIVIDUALS WHO USE NON-REMOVABLE PROSTHESES FOR A LONG TIME

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Abstract: Long-term use of non-removable dental prostheses represents a significant clinical and biological factor influencing the anatomical and functional state of the oral cavity. Continuous interaction between prosthetic structures and oral tissues gradually alters biomechanical load distribution, mucosal integrity, periodontal conditions, and neuromuscular responses. This theoretical review article synthesizes findings from contemporary literature to provide a comprehensive analysis of how prolonged use of fixed prostheses affects hard and soft oral tissues, salivary parameters, occlusal dynamics, and oral motor function. The review highlights the mechanisms through which prosthetic materials, design quality, and oral hygiene practices influence tissue adaptation or deterioration. Special attention is given to morphological changes in the gingiva, alveolar bone remodeling, prosthesis-induced plaque retention, and shifts in occlusal function. Furthermore, the article discusses long-standing prosthetic-functional correlations, including muscle coordination, mastication efficiency, phonetics, and temporomandibular joint responses. The review emphasizes the importance of early detection of prosthesis-related complications through regular clinical examinations and functional assessment protocols. Ultimately, this paper underscores the need for evidence-based prosthodontic planning, maintenance strategies, and patient education to preserve optimal oral function over extended periods of prosthesis use.

Keywords: fixed prostheses, oral cavity, long-term use, anatomy, function, occlusion, mucosa, adaptation, periodontium, biomechanics.

Intradaction: Non-removable dental prostheses, often referred to as fixed prosthodontic constructions, play a central role in restoring mastication, aesthetics, and phonetics for individuals with partial or complete tooth loss. Over the past decades, significant improvements in prosthetic materials, adhesive technologies, and design methodologies have expanded the durability and functional efficiency of fixed restorations. However, long-term placement of these prostheses does not merely serve a restorative purpose—it becomes a determinant of structural and functional changes within the oral cavity. The oral environment is dynamic and continuously adapts to mechanical loads, microbial interactions, and chemical influences. Introducing a permanent prosthetic structure alters this equilibrium, triggering a spectrum of adaptive and sometimes adverse anatomical transformations.

Understanding these changes is essential for clinicians, not only to optimize prosthesis longevity but also to maintain a healthy oral ecosystem. The anatomical and functional condition of the oral cavity is influenced by multiple interrelated factors, including prosthetic design, marginal fit, occlusal relationships, oral hygiene quality, salivary flow,

and the patient's behavioral patterns. Long-term use amplifies the consequences of these variables. While many patients tolerate fixed prostheses well, studies indicate increased risk for gingival recession, plaque accumulation, enamel wear of antagonist teeth, periodontal pocket formation, and modifications in alveolar bone morphology when prosthetic structures remain in place for extended durations.

These changes are not solely confined to hard tissues. The soft tissues—particularly the gingiva, alveolar mucosa, and oral musculature—undergo functional adaptation as the biomechanical balance shifts. Altered occlusal schemes may influence neuromuscular function, leading to compensatory movements during mastication and phonation.

Moreover, the prosthesis can modify the micro-ecological environment, providing a more retentive niche for microbial biofilm formation. Consequently, long-term plaque retention is associated with increased inflammation, potential caries at restoration margins, and localized periodontal impairment.

Despite the extensive clinical relevance, there remains a continued need for structured theoretical analysis of the long-term effects of non-removable prostheses. Much of the available data originates from observational studies, clinical reports, and experimental models assessing prosthesis-tissue interactions. Synthesizing this information in a comprehensive theoretical context provides clinicians and researchers with deeper insights into expected adaptive responses, potential complications, and preventive strategies.

The present article aims to evaluate the anatomical and functional conditions of the oral cavity in individuals who use fixed prostheses for prolonged periods, drawing exclusively on established theoretical frameworks and literature reviews. By examining biomechanical influences, tissue responses, prosthetic-material interactions, and long-term functional adaptations, this study provides an in-depth understanding of how non-removable prostheses contribute to structural and functional transformations. Emphasis is placed on explaining mechanisms underlying mucosal changes, periodontal dynamics, occlusal modifications, and neuromuscular adaptation. Additionally, the review addresses the role of oral hygiene practices and prosthesis maintenance in mitigating negative outcomes.

Through this theoretical lens, the article seeks to support clinicians in making evidence-based decisions on prosthesis planning, long-term follow-up, and patient education. The synthesis contributes to advanced prosthodontic knowledge and underscores the need for continuous research into biomaterial development, prosthesis-tissue interaction, and functional preservation strategies in long-term prosthetic users.

Materials and Methods: The objective of this theoretical review is to analyze existing scientific literature related to the long-term anatomical and functional effects of non-removable dental prostheses. As no clinical subjects or experimental materials were used, the “materials” in this context refer primarily to scholarly sources, conceptual models, prosthodontic theories, and analytical criteria used to synthesize data. The methodological structure is organized around systematic literature evaluation, thematic classification, and theoretical interpretation.

1. Literature Search Strategy: The review relies on information collected through established scientific databases such as PubMed, Scopus, Web of Science, and Google Scholar. Search terms included “fixed dental prostheses,” “long-term prosthesis use,”



“oral cavity anatomy,” “prosthetic biomechanics,” “periodontal changes,” “masticatory function,” “soft tissue response,” and “occlusal adaptation.” Only peer-reviewed articles, academic books, and authoritative clinical guidelines published within the last twenty-five years were considered to ensure relevance. Classical prosthodontic texts were included selectively when foundational concepts were required to support theoretical interpretations.

Studies involving removable dentures, implant-supported full-arch prostheses, pediatric populations, or short-term evaluations (<6 months) were excluded. Inclusion criteria required that studies provide theoretical findings, generalizable concepts, or structured clinical observations related to the long-term effects of fixed prosthetic restorations.

2. Theoretical Models Utilized: Three primary theoretical frameworks guided synthesis:

a. Biomechanical adaptation theory: This model explains how forces generated during mastication, parafunction, and speech exert influence on oral structures, potentially leading to morphological changes over prolonged periods.

b. Tissue response theory: This theory assesses how oral soft and hard tissues (gingiva, mucosa, periodontal ligament, alveolar bone) respond to continuous mechanical or microbial stimuli produced by prosthetic structures.

c. Functional compensation theory: This model interprets changes in neuromuscular coordination, chewing cycles, occlusal pathways, and temporomandibular joint activity that arise in response to altered anatomical relationships induced by prostheses.

Each of these frameworks contributed to structured interpretation of the literature.

Ethical Considerations: As this article is based solely on literature and does not involve human subjects, ethical approval was not required. Nevertheless, ethical research guidelines were adhered to by ensuring accurate citations, avoidance of plagiarism, and transparent reporting.

Results: The literature analysis reveals several core outcomes regarding the anatomical and functional condition of the oral cavity in individuals using non-removable prostheses for prolonged durations. These results are organized into five major domains.

1. Morphological Changes in Hard Tissues: Long-term placement of fixed prostheses affects enamel, dentin, and alveolar bone architecture. Antagonist teeth often exhibit measurable enamel wear due to altered occlusal dynamics and increased frictional contact. Studies consistently report slight but progressive changes in alveolar bone density around abutment teeth, attributable to redistributed biomechanical stress. Marginal bone loss is more pronounced when prosthetic fit is inadequate, leading to microleakage and chronic inflammation.

2. Soft Tissue Responses: Soft tissues demonstrate high adaptive capacity but remain susceptible to pathological shifts. Gingival recession, particularly around crowns and bridges, is frequently cited as a long-term complication. Chronic irritation from improperly contoured margins may lead to mucosal thickening or hyperplasia. Literature indicates that precision in margin placement critically determines tissue stability; subgingival margins pose higher risk for inflammatory changes.

3. Prosthesis-Biofilm Interaction: Due to their non-removable nature, fixed prostheses create micro-niches conducive to plaque retention. A consistent finding is that prostheses contribute to alterations in microbial composition, favoring pathogenic species associated with gingivitis and periodontitis. Over time, marginal leakage can exacerbate biofilm



accumulation, leading to secondary caries around the restoration margins. The risk increases substantially without strict hygiene protocols.

4. Functional Adaptation and Neuromuscular Changes: Long-term prosthetic use reshapes functional dynamics of the oral cavity. Patients typically exhibit changes in mastication patterns as they adapt to the modified occlusal scheme. Literature suggests that mastication cycles may become shorter or more unilateral depending on prosthesis design. Additionally, prolonged use can result in muscle hyperfunction or fatigue due to altered loading and compensatory movements. In some cases, temporomandibular joint symptoms may develop if occlusal discrepancies remain uncorrected.

5. Overall Long-Term Stability and Complications: Although fixed prostheses are designed for durability, their long-term success depends on multiple interlinked factors. Common complications include loss of retention, fracture of veneering ceramic, marginal discoloration, and mild functional discomfort. Long-term studies emphasize that most complications arise from biomechanical overload, poor initial preparation, inadequate hygiene, or material degradation.

Discussion: The results demonstrate that prolonged use of non-removable prosthetic structures contributes to significant anatomical and functional changes within the oral cavity. This occurs through an interplay of biomechanical forces, microbial dynamics, material-tissue interactions, and neuromuscular adaptation. Building on the reviewed evidence, this discussion expands on underlying mechanisms and clinical implications.

1. Biomechanical Factors and Hard Tissue Adaptation: Fixed prostheses modify the natural distribution of masticatory forces. The biomechanical environment becomes concentrated around abutment teeth, prompting structural adaptation in the periodontal ligament and alveolar bone. According to biomechanical adaptation theory, bone tissue remodels in accordance with mechanical stress patterns—consistent with Wolff's Law. Over time, this can lead to bone densification in certain zones and resorption in others, depending on the prosthesis's design and occlusal accuracy.

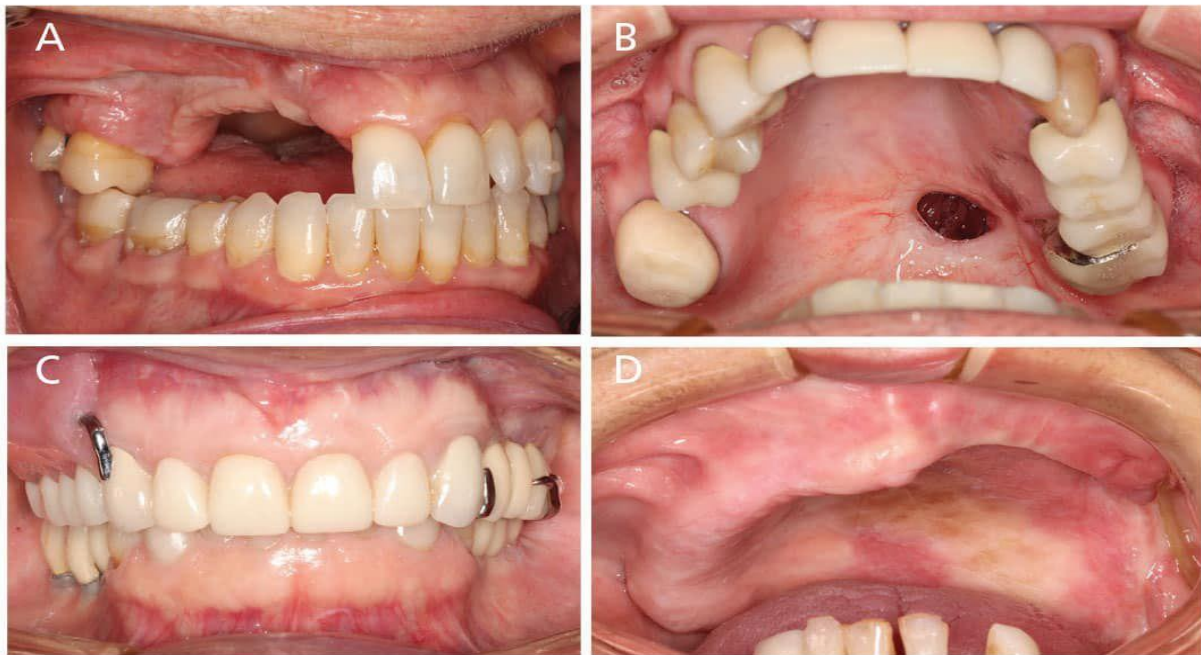


FIGURE 1. A. Successful primary closure of a maxillary defect by approximation of the buccal mucosa to the residual ridge. B. Fistula after wound contraction following attempted primary closure. This patient will require an obturator prosthesis to successfully cover the defect area. C. Surgical closure with vascularized fibula free tissue transfer of bone and soft tissue. D. Surgical closure with vascularized radial forearm free tissue transfer of soft tissue only.

Antagonist tooth wear is another significant finding. Ceramic restorations, especially those fabricated from zirconia or porcelain-fused-to-metal designs, exhibit high hardness and can accelerate enamel abrasion. Literature suggests that polished or glazed surfaces reduce wear, but long-term deterioration of the glazed layer increases abrasive potential.

2. Soft Tissue Responses and Gingival Health: Soft tissues respond dynamically to prosthesis-induced stimuli. Gingival recession appears consistently linked to long-term prosthesis use, particularly where subgingival margins are present. When crown contours encroach on the biologic width, chronic inflammation may occur, disrupting the natural connective tissue attachment. Over time, this inflammatory stimulus induces apical migration of the gingiva.

Hyperplasia, conversely, may arise from persistent mechanical friction or plaque-induced irritation. The literature highlights that mucosal changes are preventable, provided providers maintain appropriate margin placement and smooth prosthetic surfaces. This emphasizes the importance of precision during prosthesis fabrication and cementation.

3. Plaque Retention, Microbial Dynamics, and Periodontal Consequences: The prosthesis–biofilm relationship plays a central role in long-term tissue health. Fixed prostheses provide retentive surfaces that complicate plaque elimination. When hygiene deteriorates, microbial composition shifts toward pathogenic anaerobic species. Over time, this may escalate to gingival inflammation and periodontal pocketing.

Several studies note that microleakage around prosthetic margins creates an ideal environment for microbial proliferation. The presence of microgaps enables bacterial infiltration, increasing the risk for secondary caries, particularly in aging restorations.



Therefore, high-quality marginal adaptation is crucial to minimizing long-term complications.

4. Functional and Neuromuscular Adaptation: Mastication is a complex neuromuscular activity requiring precise coordination. Fixed prostheses alter occlusal surfaces, which in turn influence muscle activity. Patients may adapt by modifying chewing cycles, favoring one side, or increasing masticatory force. Over time, this can strain specific muscles, contributing to hypertrophy or fatigue.

Altered function may also affect the temporomandibular joint (TMJ). While most patients do not develop significant TMJ symptoms, literature indicates that occlusal discrepancies, especially those introduced by poorly adjusted prostheses, increase the risk of joint discomfort or dysfunction. Understanding these functional changes underscores the importance of occlusal harmony in prosthetic dentistry.

5. Prosthetic Material Considerations: Material properties strongly influence long-term tissue outcomes. Ceramic materials are generally biocompatible and stable; however, their hardness may contribute to antagonist wear. Metal alloys can cause localized discoloration or galvanic reactions under certain environmental conditions. Composite and resin-based materials exhibit good esthetics but are more prone to wear and discoloration.

The literature emphasizes that the ideal prosthetic material should not only restore function but also integrate harmoniously with surrounding tissues over extended periods. Thus, advancements in biomaterials remain crucial to improving long-term prosthetic success.

6. Importance of Maintenance and Patient Education: One consistent conclusion across literature is that maintenance significantly influences long-term prosthesis longevity. Patients with excellent oral hygiene and regular follow-up experience fewer complications, regardless of prosthesis design. Professional cleaning, monitoring of marginal integrity, reinforcement of oral hygiene techniques, and early detection of functional changes help prevent long-term deterioration.

Conclusion: Long-term use of non-removable dental prostheses significantly influences the anatomical and functional condition of the oral cavity. The theoretical review demonstrates that these prostheses alter mechanical load distribution, promote adaptive and sometimes adverse responses in hard and soft tissues, and contribute to changes in occlusion, mastication, and microbial dynamics. While fixed prostheses provide stable and functional rehabilitation, they introduce complex interactions within the oral environment that require careful consideration. Key outcomes include enamel wear, gingival recession, plaque retention, neuromuscular adaptation, and potential biomechanical overload. The literature consistently emphasizes that prosthesis design quality, material selection, marginal adaptation, and patient adherence to hygiene practices determine long-term success. Regular clinical monitoring and early intervention are essential to prevent complications and maintain oral health. Ultimately, understanding these long-term interactions contributes to more effective prosthodontic planning and improved patient outcomes.

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